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Uranium Removal in the Spent Salt Cleanup Process for Molten Salt Oxidation*

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The molten salt oxidation (MSO) is a thermal process that has the inherent capability of completely destroying organic constituents of mixed wastes, hazardous wastes, and energetic materials. The organic constituents of the waste materials are oxidized to carbon dioxide and water, while inorganic constituents, including toxic metals, minerals, and radioisotopes, are retained in the molten salt bath. As these impurities accumulate in the salt, the process efficiency drops and the salt must be replaced. An efficient process is needed to separate these toxic metals, minerals, and radioisotopes from the spent carbonate to avoid generating a large volume of secondary waste. Toxic metals such as cadmium, chromium, lead, and zinc etc., are removed by a method described elsewhere. This paper describes a novel separation strategy developed for radioisotope removal from the mixed spent salt as well as experimental results, specifically uranium as part of the spent salt cleanup. Uranium forms a highly soluble complex in carbonate solutions ($UO_2(CO_3)_3^{-4}$). Treatment with alkali (NaOH) forms insoluble sodium diuranate ($Na_2U_2O_7$) which is recovered by filtration, yielding less than ppm levels of uranium in solution. The solution is then dried and recycled back to the MSO reactor for reuse. If the spent salt contains low level of carbonate and is destined for disposal, the uranium can be removed by a chemical reduction method. The residual uranium in solution is further removed using an ion exchange resin, Diphonix, which has high selectivity for uranium at a certain pH range.

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